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Mössbauer Studies of Surface Layers

By **G.N. Belozerski**

Studies in Physical and Theoretical Chemistry Volume 81

Mössbauer spectroscopy has evolved as one of the few methods available for investigation of solids differing in depth by several orders of magnitude. This recent development has made the problems of surface investigation and the study of separate layers amenable to investigation. The parameters of the hyperfine interaction derived from the Mössbauer spectra provide valuable information on the chemical bond character and on magnetic properties of surface layers as well as on the change of the properties with the depth from the outermost surface layer. It is possible to carry out quantitative phase analysis and to use the technique to study different transformations in the solid which result from external effects under a wide range of temperatures and pressures.

This book is one of the first attempts at a consistent presentation of theoretical and practical problems of the use of Mössbauer spectroscopy to study solid surfaces, its applications, and development. The applications include: surface studies with hyperfine probes in the following fields: oxidation and corrosion of metals and alloys: passivating and protective coatings: physics of metals: annealing and quenching, mechanical and chemical treatment, ion implantation and laser treatment; texture of near-surface layers. Mössbauer spectroscopy is one of the best methods for *in situ* characterization of solid/solid and solid/solution interfaces. It lends itself to *in situ* studies of surfaces under various coatings and processes, surface magnetism and the effect of the gas phase on the properties of the surface layers and the structure and magnetic properties of epitaxially grown monolayers on the surface of oriented single crystals.

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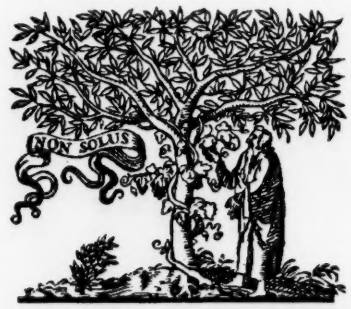

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Inorganic Polymeric Glasses

By **R.C. Ropp**, *Warren, NJ, USA*

Studies in Inorganic Chemistry Volume 15

The author describes a novel method of preparing hydrolysis-stable non-silicate glasses which is based on experimental work accomplished over the past twenty years. As such, the method is the beginning of a new approach to glass-making by the use of a molecularly-polymerizable precursor.

The book elucidates the technical details required to produce such molecularly-polymerized glasses from carefully prepared inorganic molecular monomers. Essentially, only silicate-based glasses have been known to be stable, whereas non-silicate glasses could not be attributed with such properties. Such glasses have, therefore, not found widespread usage in industry. The new phosphate glasses described here exhibit stabilities superior to many of the silicate glasses.

Researchers in glass and glass properties will find this volume extremely useful and those involved in organic polymers will be intrigued by the similarities and disparities of the two systems.

Contents: 1. Introduction to Silicate Glass Technology.
Glass and Antiquity. The Glassy or Vitreous State. Glass Formers and Glass Compositions. The Manufacture of Silicate-Based Glasses. Forming and Finishing Operations. Thermal Processing and Properties of Silicate Glasses. Inherent Properties of Glass. Silicate Glass Products Currently being Manufactured.
2. Introduction to Polymeric Glasses.
Prior Attempts to Prepare Stable Phosphate Glasses. Structural Units in Glass. Basis for Chain Structure of Polymerized Phosphates. Prior Attempts to Prepare Phosphate Glasses by the Melting of Stoichiometric Compounds. Crystalline Salt Monomers for Stable Phosphate Glass Preparation.
3. Factors Contributing to the Preparation of Stable Phosphate Glasses.
Anomalous Recrystallization of Polymeric Calcium Phosphate Glass. Abnormal Strain Relief Behavior of Polymeric $[Ca(PO_3)_2]_n$ Glass. The Effect of Melt Hold Time on Glass Points. Measurement of Hydrolysis Stability of Polymerized Glasses. Effects of Purity and Melt Hold Time on Hydrolysis Stability of Polymerized Glasses. Effect of Melt Hold Time on Melt Viscosity. Effect of Excess H_3PO_4 on the Reaction Paths of Monobasic Salts. Effect of Ca/P Ratios on Stability of Polymerized Glass Compositions. Other Polymerized Alkaline Earth Phosphate Glasses. Effect of Crucibles Used to Hold the Melt during Polymerization. The Combined Effects of Purity and MHT upon Polymerization.
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5. Uses of Polymeric Phosphate Glasses.
Nuclear Waste Sources. History of Glass as a Nuclear Waste Encapsulent. Polymeric Phosphate Glass and Nuclear Waste Encapsulation. Properties of a Polymeric Phosphate Glass Containing Nuclear Waste. Luminescent Polymeric Phosphate Glass and its Applications. Other Potential Uses of Polymeric Glass.
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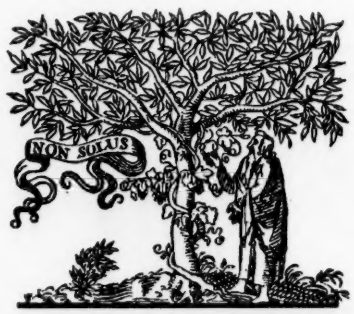

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Dynamics of Excited Molecules

Edited by **Kozo Kuchitsu**

Studies in Physical and Theoretical Chemistry Volume 82

The physical and chemical properties of the molecular species reviewed in this book, and sometimes the species themselves, had been postulated or predicted but their exact details remained essentially unexplored for decades. The recent advances in chemical physics (such as laser spectroscopy and quantum-theoretical calculations) have provided techniques for their unambiguous identification. Accurate data on their structures and dynamics are now available. Such information is indispensable for detailed discussion on the various properties of molecules and the mechanisms of intermolecular interactions and chemical interactions.

Information on the dynamics of excited molecules constitutes a firm basis of modern chemistry and physics. Moreover, it is of paramount importance in various fields of basic and applied sciences where chemical reactions play important roles: atomic and molecular physics, atmospheric and environmental science, space science, materials science, and biology.

This book contains 13 review articles on
(1) the techniques for production and identification of excited molecules in the gas phase, condensed phases, and intermediate phases (intermolecular complexes and atomic or molecular microclusters)
(2) their structures and dynamics (internal reactions) observed mainly by spectroscopic experiments
(3) their important roles in chemical processes. The target chemical species range from diatomics to relatively complicated aromatics in a variety of electronic and vibrational excited states, many of them being nonrigid or short-lived molecules, radicals, and positive or negative ions.

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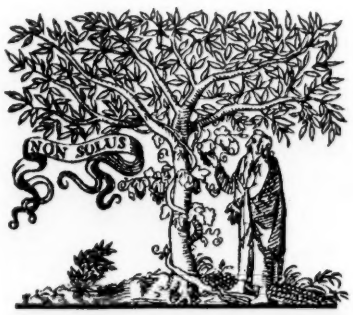

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Physico-Chemical Properties of Selected Anionic, Cationic and Nonionic Surfactants

by **N.M. van Os, J.R. Haak** *and* **L.A.M. Rupert**

The number of physico-chemical investigations of surfactants in solution, whether aqueous or nonaqueous, has dramatically increased in recent years. However, literature reports on surfactants in solutions are scattered over a plethora of scientific journals and books which differ widely in scope and readership. Such data are often difficult to retrieve because there have been no systematic compilations, with the exception of those for CMCs and for micelle aggregation numbers.

The present compilation meets that need by covering, as completely as possible, the physicochemical properties of selected series of homologous surfactants. These surfactants are in most cases isomerically pure, are well-known, and have been used in numerous academic and industrial studies. The properties include aggregation number, cloud point, CMC, ^{13}C-NMR, correlation length, counterion binding, density, enthalpy of micelle formation, entropy of micelle formation, Gibbs' free energy of micelle formation, head group area, ^{1}H-NMR, hydration number, Krafft temperature, melting point, micelle radius, microscopic viscosity, miscibility curve, partial molar volume, phase inversion temperature, refractive index, self- diffusion coefficient, surface tension, and upper critical temperature. The book also contains two- and three-component phase diagrams of many nonionic surfactants.

The solvent is water in most cases; however, some data refer to properties in D_2O, electrolyte solutions, and nonaqueous solvents. The variables are temperature and concentration. Where possible, the method of measurement is given. Data on the purity of the compounds and the accuracy of the measurement methods are not included, as these can easily be found in the original sources, which mostly date from the period 1970-1991 and are given at the end of each chapter. The Index section contains a compound index, a property index, a symbol index and a cross index which facilitate easy access to the data.

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Part III: Nonionic Surfactants. Alkylpolyoxyethylene Glycol Ethers. Alkylphenol(ethylene oxide) Ethers.
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